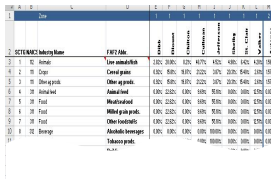
# Integrating Freight Data into Transportation Models




**Michael Anderson**
**Gregory Harris**


**TMIP Webinar**

**February 5, 2010**

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## Presentation Outline

**Integrated Freight Planning Framework**

**Freight Data**

**Data Manipulation**

**Freight Analysis Zones (FAZs)**

**Statewide Freight Forecasting Model**

**Local Industry Surveys**

**MPO Freight Forecasting Model**

**Simulation of Freight Data**

**Using the Data – Putting it all together!**

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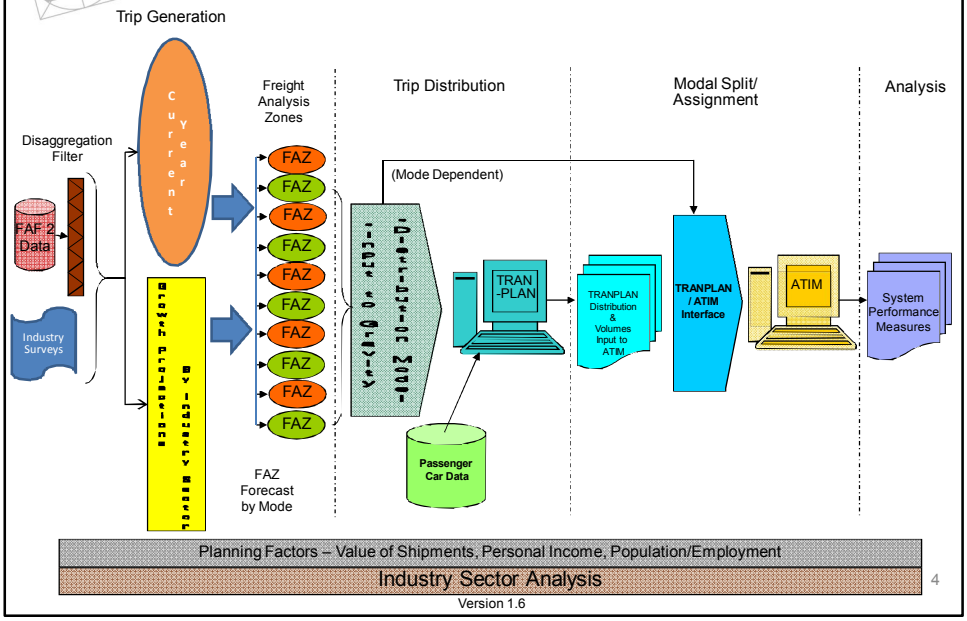
# Integrated Freight Planning Framework



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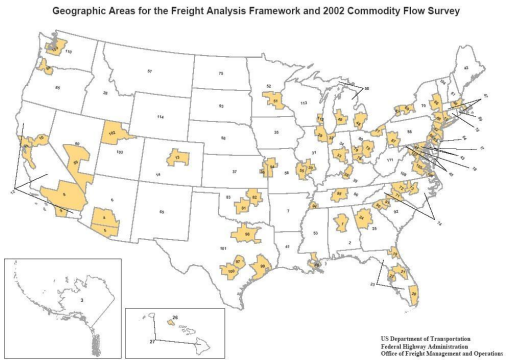
## Freight Analysis Framework Version 2.2

- 114 Zones
- 17 Ports of Entry



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## FAF2 Database Screenshot

| Origin | Ost | Destination | Dst | Commod | Port | Mode | 2002 | 2035 |
|---|---|---|---|---|---|---|---|---|
| AL Birmi | AL | SW Asia | SW | Coal-n.e.c. | TX rem | Rail | 0.32 | 0.0945 |
| AL Birmi | AL | SW Asia | SW | Coal-n.e.c. | TX rem | Truck | 0.002 | 0.0006 |
| AL Birmi | AL | SW Asia | SW | Chemical prods. | TX rem | Truck | 0.006 | 0.0289 |
| AL Birmi | AL | SW Asia | SW | Coal-n.e.c. | TX-Beaumon | Rail | 0.01 | 0.003 |
| AL Birmi | AL | SW Asia | SW | Coal-n.e.c. | TX-Corpus Ch | Rail | 0.34 | 0.1004 |
| AL Birmi | AL | SW Asia | SW | Coal-n.e.c. | TX-Corpus Ch | Truck | 0.002 | 0.0006 |
| AL Birmi | AL | SW Asia | SW | Nonmetal min. prods. | VA rem | Truck | 0.02 | 0.1075 |
| AL Birmi | AL | SW Asia | SW | Base metals | VA rem | Truck | 0.31 | 0.3551 |
| AL Birmi | AL | SW Asia | SW | Machinery | VA rem | Other Intermoc | 0.02 | 0.0271 |
| AL Birmi | AL | SW Asia | SW | Machinery | VA rem | Truck | 0.43 | 0.5835 |
| AL Birmi | AL | SW Asia | SW | Mixed freight | VA rem | Truck | 0.01 | 0.0185 |
| AL rem | AL | Americas | AM | Other ag prods. | AL rem | Truck | 0.02 | 0.055 |
| AL rem | AL | Americas | AM | Coal-n.e.c. | AL rem | Pipeline & Unk | 0.1 | 0.1562 |
| AL rem | AL | Americas | AM | Coal-n.e.c. | AL rem | Truck | 0.05 | 0.0781 |
| AL rem | AL | Americas | AM | Chemical prods. | AL rem | Truck | 0.15 | 0.7892 |
| AL rem | AL | Americas | AM | Base metals | AL rem | Truck | 0.004 | 0.0221 |
| AL rem | AL | Americas | AM | Machinery | AL rem | Pipeline & Unk | 0.009 | 0.0213 |
| AL rem | AL | Americas | AM | Machinery | AL rem | Truck | 0.12 | 0.2845 |
| AL rem | AL | Americas | AM | Mixed freight | AL rem | Pipeline & Unk | 0.002 | 0.0024 |
| AL rem | AL | Americas | AM | Mixed freight | AL rem | Truck | 0.17 | 0.2022 |
| AL rem | AL | Americas | AM | Live animals/fish | AL-Mobile | Truck | 0.02 | 0.0438 |
| AL rem | AL | Americas | AM | Cereal grains | AL-Mobile | Truck | 0.45 | 0.6215 |
| [illegible] | [illegible] | Americas | AM | Other ag prods. | [illegible] | Pipeline & Unk | 0.03 | 0.0648 |

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# SCTGs & NAICS

**SCTG Code Matchup With NAICS Codes – (Partial Table)**

| SCTG Code | Name | NAICS Code | Name |
|---|---|---|---|
| **1** | **Animals** | **111** | **Animals** |
| **2** | **Grains** | **112** | **Grains** |
| 3 | Other | | |
| 4 | Animal Feed | 311 | Food Processing |
| 5 | Meat, Seafood | | Food Processing |
| 6 | Bakery Goods | | Food Processing |
| 7 | Other | | Food Processing |
| 8 | Alcohol | 312 | Alcohol, Tobacco |
| 9 | Tobacco | | Alcohol, Tobacco |
| 10 | Stone | 212 | Stone, Clay, Gravel |
| 11 | Sand | | Stone, Clay, Gravel |
| 12 | Gravel | | Stone, Clay, Gravel |
| 13 | Non-metallic Minerals | | Stone, Clay, Gravel |
| 14 | Metallic Ores | | Stone, Clay, Gravel |
| **15** | **Coal** | | **Coal** |
| **16** | **Crude Oil** | **211** | **Petroleum** |
| 17 | Gasoline | 324 | Refineries |
| 18 | Fuel Oils | | Refineries |
| 19 | Other | | Refineries |
| 20 | Basic Chemicals | 325 | Chemicals |
| 21 | Pharmaceuticals | | Chemicals |
| 22 | Fertilizers | | Chemicals |
| 23 | Other | | Chemicals |
| 24 | Plastics | 326 | Plastics |
| **25** | **Logs** | **113** | **Logs** |

- Matchup of SCTG's and NAIC's classifications
- Of the 43 SCTG codes, 14 have counterparts under the NAICS classification at the three digit level
- Two of the SCTG categories – mixed freight; and waste and scrap – have no NAICS counterparts



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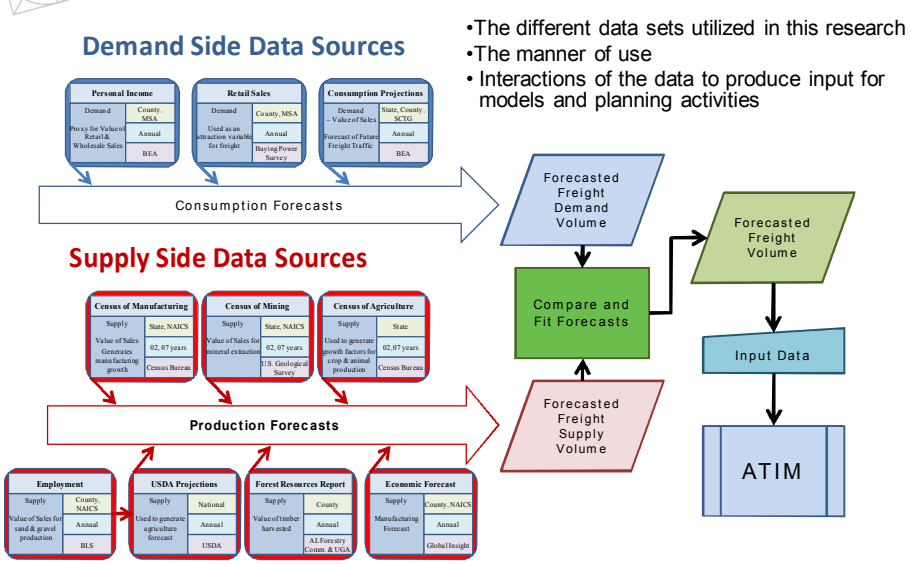
# Data Sets Utilized

- The different data sets utilized in this research
- The manner of use
- Interactions of the data to produce input for models and planning activities



## Estimating the Value of Sales and Personal Income

| Data Source | Data Obtained |
|---|---|
| Census of Manufacturing | Value of sales for manufacturing |
| Census of Agriculture | Value of sales data by crop or animal sold |
| Census of Mining | Production and sales data by geological area |
| County Business Patterns | Smaller sand and gravel operations |
| County Business Patterns | Total employment by county by sector |
| Alabama Forestry Commission | Physical amount of logs harvested |
| 2002 Pricing Data for the South (published by the Daniel B. Warnell School of Forestry Resources, University of Georgia) | Value of logs |
| Bureau of Economic Analysis (Regional Economic Accounts database) | Personal income by county |



## Determining a County's Economic Base

- Each county's economic base must be defined in order to properly gauge the amount of future freight traffic that will be entering and leaving.
- For freight modeling purposes, the economic base can be defined as all goods producing industries within a county.
- For Alabama counties, the economic base includes:
  - Major manufacturing industries
  - Agriculture
  - Logging
  - Mining
  - Retailing
  - Wholesaling
  - Warehousing

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# Economic Data

**Value of Sales - Autauga**

| SCTG | NAICS | Industry Name/Manufacturing Group | # of EMP | 2002 Value of Sales ($1000) | 2002 Value of Sales/EMP | 2002 Value of Sales (multiplied by $1000) | 2002 Value of Sales/EMP | 2002-2005 Growth Factor | 2005 Value of Sales | 2005-2035 Growth Factor | 2035 Value of Sales |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 111 | Animals | 277 | $4,787 | $17 | $4,787,000 | $17,282 | 1.020 | $4,883 | 1.491 | $7,280 |
| 2 | 112 | Crops/Grains | 277 | $8,129 | $29 | $8,129,000 | $29,347 | 1.034 | $8,405 | 1.402 | $11,786 |
| 25 | 113 | Logging | | $3,775 | | $3,775,000 | | 1.017 | $3,839 | 1.182 | $4,538 |
| 10,11,12 | 2123 | Stone, Gravel, Sand, Clay | 60 | $10,166 | $169 | $10,166,000 | $169,433 | 1.029 | $10,461 | 1.530 | $16,005 |
| **Sum of Agriculture/Mining Data by County** | | | **614** | **$26,857** | **$72** | **$26,857,000** | **$216,061** | | **$27,588** | | **$39,608** |
| 27 | 322 | Paper | 750 | $319,500 | $426 | $319,500,000 | $426,000 | 0.991 | $316,625 | 1.397 | $442,324 |
| **Sum of Manufacturing Data by County** | | | **750** | **$319,500** | **$426** | **$319,500,000** | **$426,000** | | **$316,625** | | **$442,324** |
| County Total | | Manufacturing | 750 | $319,500 | $426 | $319,500,000 | $426,000 | 0.991 | $316,625 | 1.397 | $442,324 |
| **Sum of All County Data** | | | **1364** | **$346,357** | **$254** | **$346,357,000** | **$253,927** | | **$344,213** | | **$481,933** |

**Value of Sales - Baldwin**

| SCTG | NAICS | Industry Name/Manufacturing Group | # of EMP | 2002 Value of Sales ($1000) | 2002 Value of Sales/EMP | 2002 Value of Sales (multiplied by $1000) | 2002 Value of Sales/EMP | 2002-2005 Growth Factor | 2005 Value of Sales | 2005-2035 Growth Factor | 2035 Value of Sales |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 111 | Animals | 599 | $7,701 | $13 | $7,701,000 | $12,856 | 1.020 | $7,855 | 1.491 | $11,712 |
| | | | 599 | $71,053 | | | | | $73,469 | 1.402 | $103,011 |

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# Economic Data (2)

- Use public sources:
  - Economic Census, mining & forestry reports, etc.
- Collate county employment and VoS data by zone
- Determine county weights for each zone

| SCTG | NAICS | Industry Name | FAF2 Abbr. | Bibb | Blount | Chilton | Cullman | Jefferson | Shelby | St. Clair | Walker |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Zone | | | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 1 | 112 | Animals | **Live animals/fish** | 2.82% | 20.00% | 8.21% | 48.77% | 4.52% | 4.98% | 6.42% | 4.28% |
| 2 | 111 | Crops | **Cereal grains** | 0.92% | 15.81% | 19.87% | 21.22% | 3.87% | 20.31% | 15.40% | 2.61% |
| 3 | 111 | Other ag prods. | **Other ag prods.** | 0.92% | 15.81% | 19.87% | 21.22% | 3.87% | 20.31% | 15.40% | 2.61% |
| 4 | 311 | Animal feed | **Animal feed** | 0.00% | 22.62% | 0.00% | 9.69% | 55.18% | 0.00% | 0.00% | 12.51% |
| 5 | 311 | Food | **Meat/seafood** | 0.00% | 22.62% | 0.00% | 9.69% | 55.18% | 0.00% | 0.00% | 12.51% |
| 6 | 311 | Food | **Milled grain prods.** | 0.00% | 22.62% | 0.00% | 9.69% | 55.18% | 0.00% | 0.00% | 12.51% |
| 7 | 311 | Food | **Other foodstuffs** | 0.00% | 22.62% | 0.00% | 9.69% | 55.18% | 0.00% | 0.00% | 12.51% |
| 8 | 312 | Beverage | **Alcoholic beverages** | 0.00% | 0.00% | 0.00% | 0.00% | 100.00% | 0.00% | 0.00% | 0.00% |
| | | | **Tobacco prods.** | | | | 0.00% | 100.00% | 0.00% | 0.00% | 0.00% |

## Data Sources and Update Schedule

| Data Items | Frequency | Next Update | Source |
|---|---|---|---|
| County Baseline Data | | | |
| Manufacturing | 5 years | 2009 | US Census of Manufacturing |
| Agriculture | 5 years | 2009 | US Census of Agriculture |
| Logging | 5 years | 2009 | Alabama Forestry Commission |
| Mining | 5 years | 2009 | US Census of Mining |
| | | | US Geological Survey |
| | | | County Business Patterns |
| Growth Projections | | | |
| Manufacturing | 1 year | 2010 | Global Insight |
| Agriculture | 1 year | 2010 | US Dept. of Agriculture |
| | | | Economic Research Service |
| Mining | 1 year | 2010 | US Geological Survey |
| | | | US Dept. of Energy |
| | | | Energy Information Agency |
| County Personal Income | | | |
| | 1 year | 2010 | US Dept. of Commerce |
| | | | Bureau of Economic Analysis |



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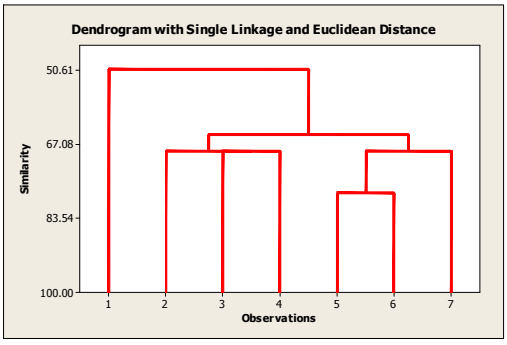
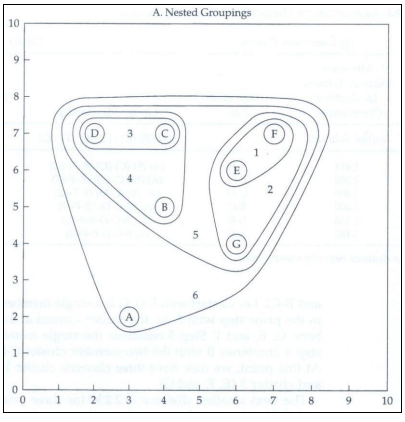
## Developing FAZ – Cluster Analysis

- Multivariate technique that seeks to group objects based on their characteristics
- Classifies objects so that each object is very similar to others in the cluster with respect to some predetermined selection criteria
- Clusters of objects have
  - high internal homogeneity
  - high external heterogeneity

•Source: Multivariate Data Analysis 6th Edition – Hair, Black, Babin, Anderson, and Tatham, 2006

## Cluster Analysis Example




•Source: Multivariate Data Analysis 6th Edition – Hair, Black, Babin, Anderson, and Tatham, 2006

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# Ward's Method

- Joins two clusters whose combination minimizes the increase in within-cluster sum of squares (i.e., minimum within-group variance)
- Tends to produce equally sized clusters

•Source: *Analyzing Multvariate Data*, Lattin, Carroll, and Green, 2003

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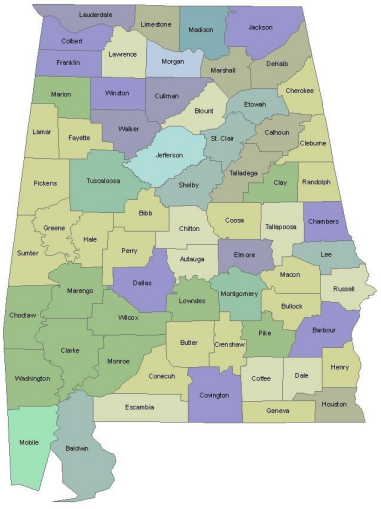
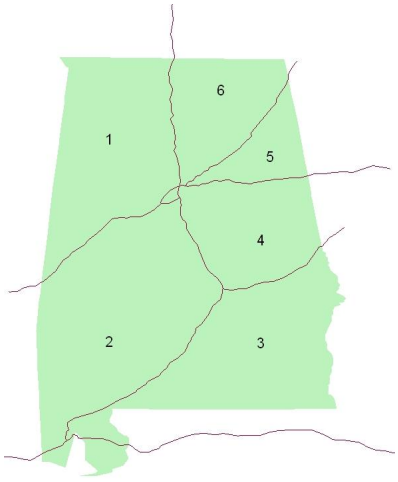
# Initial Clustering Economic Variables Only




Observations

- Cluster elements dispersed across state
- Need to include measures of proximity
  - Longitude
  - Latitude
  - Distance from interstate
- Consider dividing state into sectors

# Interstate Sectors in Alabama



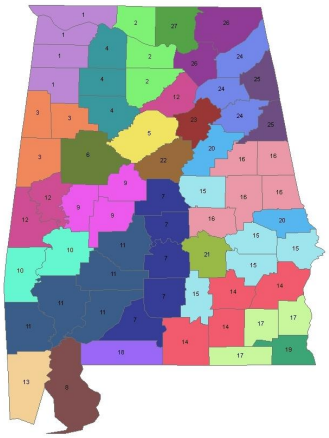

Advantages

- Natural boundaries
- Primary pathways into the sectors
- Not an arbitrary division of state

# Statewide FAZs

- Cluster Analysis
- 67 Counties
- 27 FAZs

- Used
  - Income
  - Value of Shipment
  - Popluation
  - Employment
  - Location
  - Distance from Interstate



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## Transportation Networks

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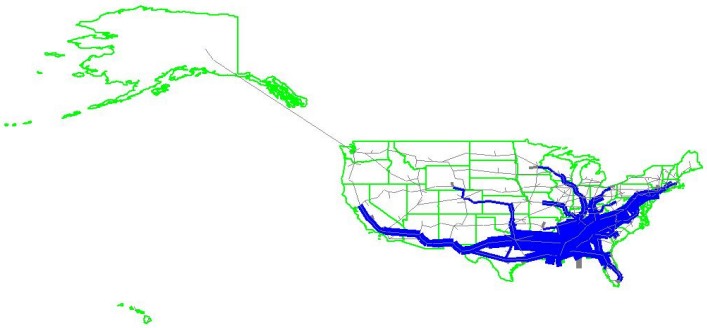
## Alabama IE, EI and EE Flows



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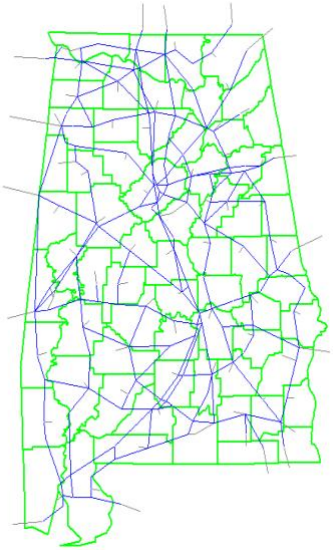
## Application of FAF2 – Statewide/MPO

- Internal to Zone 1
- Internal to Zone 2
- From Zone 1 to Zone 2
- From Zone 2 to Zone 1
- From Zone 1 to locations outside Alabama
- From Zone 2 to locations outside Alabama
- From outside Alabama to Zone 1
- From outside Alabama to Zone 2
- National Pass-Through



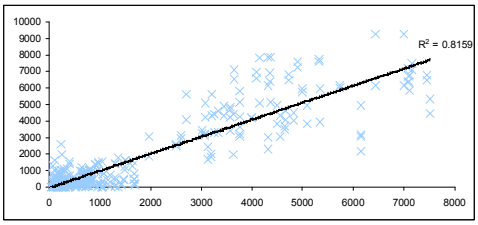
# FAF2 - Alabama Statewide Model

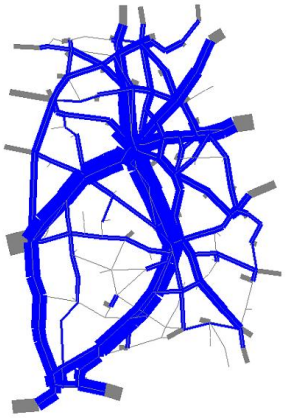
$$PA_i = (NFD) * \left[ \frac{W_1 * P_i}{\sum P_j} + \frac{W_2 * PI_i}{\sum I_j} + \frac{W_3 * E_i}{\sum E_j} + \frac{W_4 * VOS_i}{\sum VOS_j} \right]$$

$$\sum PA_i = \sum NFD_{ab}$$

$$\sum_{i=1}^{4} W_i = 1$$

$$W_i = Range(0,1)$$



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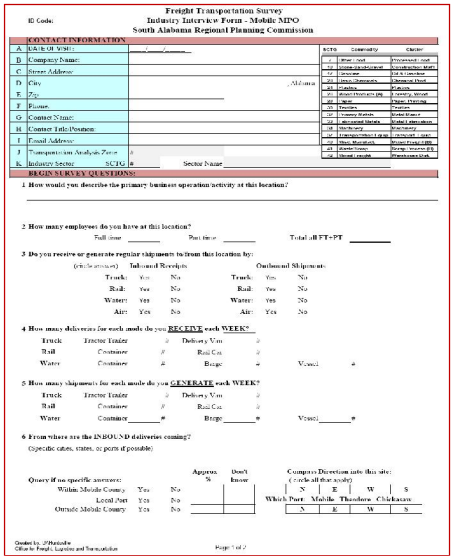
**Using the Data – Putting it all together!**

# The Challenge

- What can industry input provide when developing a long-term freight plan?
  - Gain insight from companies to plan for pattern shifts, network realignments, or current industry trends.
  - Build relationships with business leaders so they become a vital source of planning intelligence.

# Data Collection Tool



Freight Transportation Survey
Industry Interview Form - Mobile MPO
South Alabama Regional Planning Commission

ID Code:

CONTACT INFORMATION

| | | |
|---|---|---|
| A | Date of Visit: | / / |
| B | Company Name: | |
| C | Street Address: | |
| D | City | , Alabama |
| E | Zip | |
| F | Phone | |
| G | Contact Name: | |
| H | Contact Title/Position: | |
| I | Email Address: | |
| J | Transportation Analysis Zone # | |
| K | Industry Sector | SCIAG # Sector Name |

BEGIN SURVEY QUESTIONS:

1 How would you describe the primary business operation/activity at this location?

2 How many employees do you have at this location?
Full time _____ Part time _____ Total all FT+PT _____

3 Do you receive or generate regular shipments to/from this location by:
(circle all that apply) Inbound Receipts Outbound Shipments
Truck: Yes No Truck: Yes No
Rail: Yes No Rail: Yes No
Water: Yes No Water: Yes No
Air: Yes No Air: Yes No

4 How many deliveries for each mode do you RECEIVE each WEEK?
Truck Tractor Trailer # Delivery Van #
Rail Container # Rail Car #
Water Container # Barge # Vessel #

5 How many shipments for each mode do you GENERATE each WEEK?
Truck Tractor Trailer # Delivery Van #
Rail Container # Rail Car #
Water Container _____ # Barge _____ # Vessel _____ #

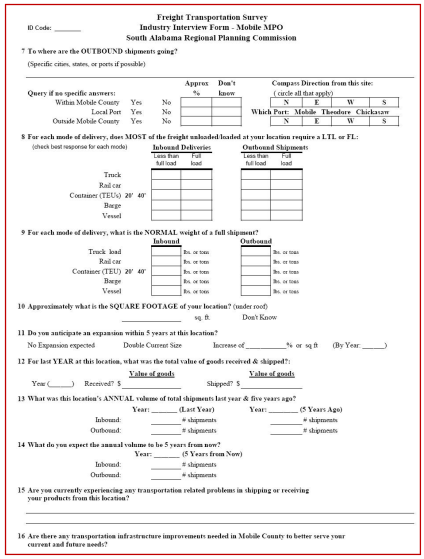
6 From where are the INBOUND deliveries coming?
(Specific cities, states, or ports if possible)

| Query if no specific answers: | | | Approx % | Don't know |
|---|---|---|---|---|
| Within Mobile County | Yes | No | | |
| Local Port | Yes | No | | |
| Outside Mobile County | Yes | No | | |

Compass Direction from this site: (circle all that apply)
N E W S
Which Port: Mobile Theodore Chickasaw
N E W S

Created by: JJ Hasfurther
Office for Freight, Logistics and Transportation

Page 1 of 2



Freight Transportation Survey
Industry Interview Form - Mobile MPO
South Alabama Regional Planning Commission

ID Code: _____

7 To where are the OUTBOUND shipments going?
(Specific cities, states, or ports if possible)

| Query if no specific answers: | | | Approx % | Don't know |
|---|---|---|---|---|
| Within Mobile County | Yes | No | | |
| Local Port | Yes | No | | |
| Outside Mobile County | Yes | No | | |

Compass Direction from this site: (circle all that apply)
N E W S
Which Port: Mobile Theodore Chickasaw
N E W S

8 For each mode of delivery, does MOST of the freight unloaded/loaded at your location require a LTL or FL:
(check best response for each mode)

| | Inbound Deliveries: Less than full load | Inbound Deliveries: Full load | Outbound Shipments: Less than full load | Outbound Shipments: Full load |
|---|---|---|---|---|
| Truck | | | | |
| Rail car | | | | |
| Container (TEUs) 20' 40' | | | | |
| Barge | | | | |
| Vessel | | | | |

9 For each mode of delivery, what is the NORMAL weight of a full shipment?

| | Inbound | Outbound |
|---|---|---|
| Truck load | lbs. or tons | lbs. or tons |
| Rail car | lbs. or tons | lbs. or tons |
| Container (TEU) 20' 40' | lbs. or tons | lbs. or tons |
| Barge | lbs. or tons | lbs. or tons |
| Vessel | lbs. or tons | lbs. or tons |

10 Approximately what is the SQUARE FOOTAGE of your location? (under roof)
_____ sq. ft. Don't Know

11 Do you anticipate an expansion within 5 years at this location?
No Expansion expected Double Current Size Increase of _____% or sq ft (By Year: _____)

12 For last YEAR at this location, what was the total value of goods received & shipped?:
Value of goods Value of goods
Year (_____) Received? $ _____ Shipped? $ _____

13 What was this location's ANNUAL volume of total shipments last year & five years ago?
Year: _____ (Last Year) Year: _____ (5 Years Ago)
Inbound: _____ # shipments _____ # shipments
Outbound: _____ # shipments _____ # shipments

14 What do you expect the annual volume to be 5 years from now?
Year: _____ (5 Years from Now)
Inbound: _____ # shipments
Outbound: _____ # shipments

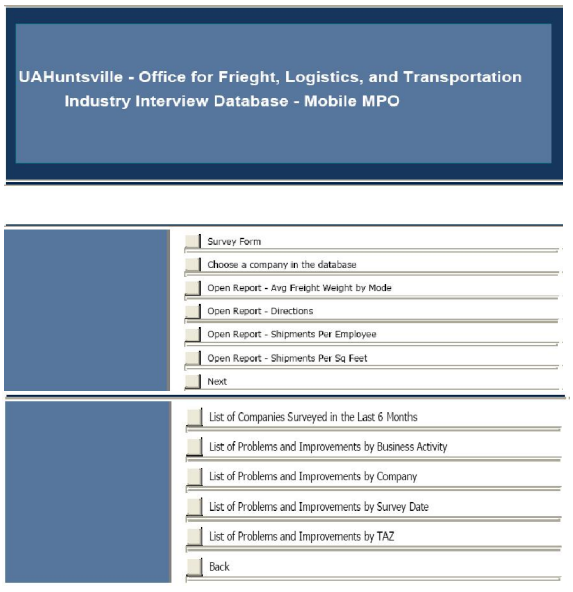
15 Are you currently experiencing any transportation related problems in shipping or receiving your products from this location?

16 Are there any transportation infrastructure improvements needed in Mobile County to better serve your current and future needs?

# Key Data Points

1. Business description
2. Number of employees
3. Mode of shipments
4. Number of deliveries received by mode weekly
5. Number of shipments by mode generated weekly
6. Origins of inbound deliveries (at least compass direction)
7. Destinations of outbound shipments (at least compass direction)
8. Size of shipment by mode (Full load, Less than full load)
9. Weight of shipments in pounds by mode (average/normal)
10. Size of facility in square feet (under roof)
11. Expansion plans for forecast period (5 years)
12. Value of Goods (dollars)
13. Actual annual volume of goods for prior year (should approximate Q5+Q6 x 52)
14. Forecasted annual volume of goods for next year
15. Transportation problems at their location
16. Transportation problems in the region

# Database Menu Screens



# Database Reports

UAHuntsville - Office for Frieght, Logistics, and Transportation
Annual Shipments by Employee and by Industry Report - Mobile MPO

| | Inbound | Outbound | # Employees |
|---|---|---|---|
| Food Shipments | | | |
| Construction Ma | | | |
| Petroleum | | | |
| Chemicals | | | |
| Plastics | | | |
| Wood Products | | | |
| Paper | | | |
| Textiles | | | |
| Primary Metals | | | |
| Fabricated Meta | | | |
| Machinery | | | |
| Transportation | | | |
| Misc Manufactu | | | |
| Waste And Scrap | | | |
| Mixed Freight | | | |

Wednesday

UAHuntsville - Office for Frieght, Logistics, and Transportation
Annual Shipments per Square Feet and by Industry Report- Mobile MPO

| | Inbound / sq ft | Outbound / sq ft | 1000 per Sq Feet |
|---|---|---|---|
| Food Shipments | 11.09 | 26.34 | 464.00 |
| Construction Mat | 113.45 | 165.45 | 55.00 |
| Petroleum | 1.13 | 2.88 | 1,300.00 |
| Chemicals | 15.25 | 23.75 | 208.00 |
| Plastics | 6.16 | 217.84 | 37.00 |
| Wood Products | 75.56 | 71.76 | 100.00 |
| Paper | 42.18 | 52.06 | 900.00 |
| Textiles | 26.00 | 19.76 | 50.00 |
| Primary Metals | 1.12 | 56.73 | 55.00 |
| Fabricated Metals | 10.70 | 10.70 | 262.40 |
| Machinery | 25.43 | 15.92 | 229.00 |
| Transportation | 7.01 | 244.52 | 215.00 |
| Misc Manufacturing | 42.36 | 45.15 | 428.46 |
| Waste And Scrap | 104.00 | 62.40 | 15.00 |
| Mixed Freight | 15.02 | 19.61 | 1,087.00 |

UAHuntsville - Office for Frieght, Logistics, and Transportation
Report of the industry- Mobile MPO

| Freight To/From Mobile | To Mobile | From Mobile |
|---|---|---|
| Within Mobile County | 31.12% | 26.82% |
| Ports in Mobile | 1.63% | 1.26% |

UAHuntsville - Office for Frieght, Logistics, and Transportation
Annual Report by Industry- Mobile MPO
Average Weight by Mode in Pounds

| | Inbound (in Pounds) | Outbound (in Pounds) |
|---|---|---|
| Truck | 44,370.37 | 41,625.00 |
| Rail Car | 158,428.57 | 177,833.33 |

| | Inbound Receipts | Outbound Shipments |
|---|---|---|
| Truck | 97.06% | 91.18% |
| Rail | 22.06% | 10.29% |

| Freight To/From Mobile | To Mobile | From Mobile |
|---|---|---|
| North | 38.50% | 44.19% |
| East | 31.32% | 12.63% |
| West | 23.47% | 38.71% |
| South | 6.71% | 4.47% |
| Total | 100.00% | 100.00% |

# Data Collection

- Collect data continually through a regular process.
  - Identify companies (zone dispersion, industry type)
  - Make appointments
  - Confirm appointments
  - Visit the companies to interview
  - Complete the data tool promptly
  - Send a note of thanks to the contacts
  - Constantly be alert for supplemental data (newspapers, chambers, etc.)
  - Rinse & repeat (annually or biannually)

## Conclusions to Local Data Collection

The information gathered through this process, along with information on commodity flows from around the country, allowed the MPO to produce an intelligent estimate of freight movement within the study area and resulted in a validated transportation model.

## Presentation Outline

**Integrated Freight Planning Framework**

**Freight Data**

**Data Manipulation**

**Freight Analysis Zones (FAZs)**

**Statewide Freight Forecasting Model**

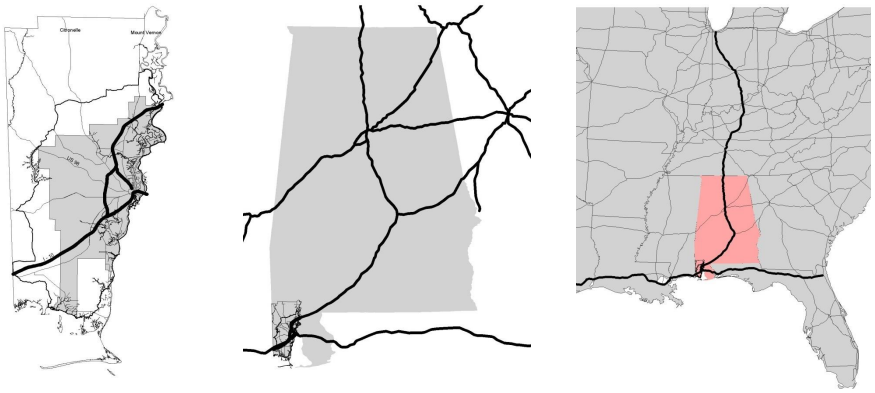
**Local Industry Surveys**

**MPO Freight Forecasting Model**

**Simulation of Freight Data**

**Using the Data – Putting it all together!**

# Mobile, AL



Mobile, AL: Convergence of two Interstates:
I-10 running EW
I-65 running NS



# Mobile's Freight Reality

- 4 class I Railroads in Mobile
- Mouth of Alabama's inland Waterways; 4500 miles of system via Tenn-Tom
- 25 steam ship agencies
- 4 foreign trade zones
- 60 trucking companies
- 4 bulk liquid terminals
- 13 warehouses, 9 of which are US Customs bonded
- 16 shipbuilding or ship repair companies

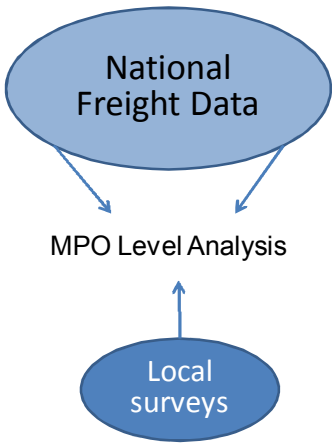
## Freight Modeling

- Before this project the amount of freight explicitly modeled - None!
- State of Alabama used “estimated” percentages for truck trips
- Truck trips were estimated percentage as a Non Home Based trips
- Trucks are not factored in the External to External trips, or Internal / External Trips
- No mode other than cars are modeled



## Modeling Goals

- Develop a freight OD matrix
- Develop a regional freight profile, with potential freight projects identified as an element to LRTP



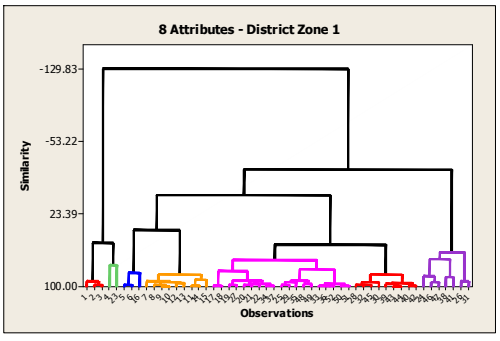
# FAZs at the Local Level

- Mobile, AL
- 300+ existing TAZ in Urban Model
  - Few Freight Generators
- Identified 5 Districts
- 40 Factors



# Mobile, AL FAZ Development

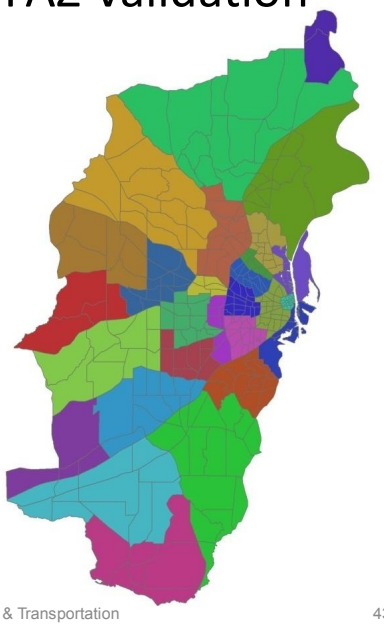
| District Zone | Number of zones | Number of Clusters | Sequence Allotment |
|---|---|---|---|
| 1 | 52 | 4 | 1-4 |
| 2 | 82 | 9 | 5-13 |
| 3 | 102 | 9 | 14-22 |
| 4 | 45 | 2 | 23-24 |
| 5 | 31 | 3 | 25-27 |



## FAZ Validation

- Industry Types
- Industry Concentrations
- Similar TAZs

- Resulted in 27 FAZs





## Trip Purposes

- External-External
- Nation-Alabama
- Nation-Mobile County
- Alabama-Mobile County
- Port-Nation
- Port-Alabama
- Port-Mobile County
- Internal to Mobile

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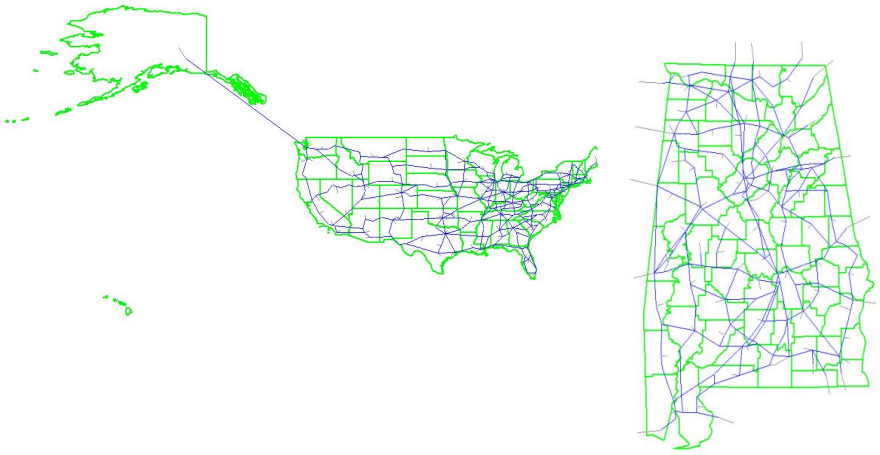
# Transportation Networks





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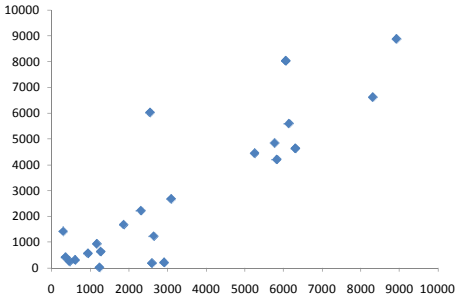
# Mobile Freight Assignment




## Results

- Combination of FAF2 data and Regional Freight Profile
- Freight OD Matrix Entered as Preload Freight Planning Framework
- New Ability to Model Truck Trips
- Use of FAF2 forecasts and socio-economic projection for LRTP
- Analyze projects considering freight impacts
- Validated freight model for road network



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## State and Local Simulations

- Development and Implementation of ATIMv2
  - Agent-based Traffic Simulation
  - Event-Driven Execution
  - Multi-Threaded Model-Viewer-Controller Architecture
  - User Interface and Interactive Tools
  - Development of the Rail Network



## Motivation

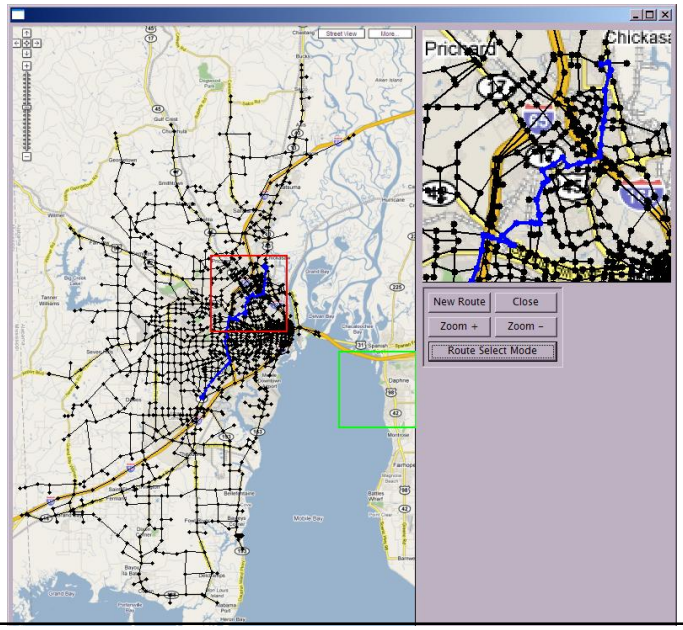
- Model freight movement through the state or municipal planning region
  - Road, Rail, Waterway
- Follow flows
  - By vehicle
  - By commodity (automotive, energy, military, etc.)
  - By estimated dollar value
- Identify problems
  - Network bottlenecks
  - Busy traffic times
- Test alternatives
  - New arteries/facilities
  - Scheduling strategies

## Agent-Based Discrete Event Model (Java)

- Architecture: agent-based, event-driven discrete event simulation
- Advances
  - Visualization capability from ground up
  - Ability to model particular events (accidents, etc.)
  - Very easy to modify network—XML network is read at runtime
    - inclusion of new arteries/facilities is no problem
  - Different vehicle types (cars, trucks, trains so far)
  - Different driver types
- Limitations
  - Limited validation (so far)



## On-the-Fly Route Planning



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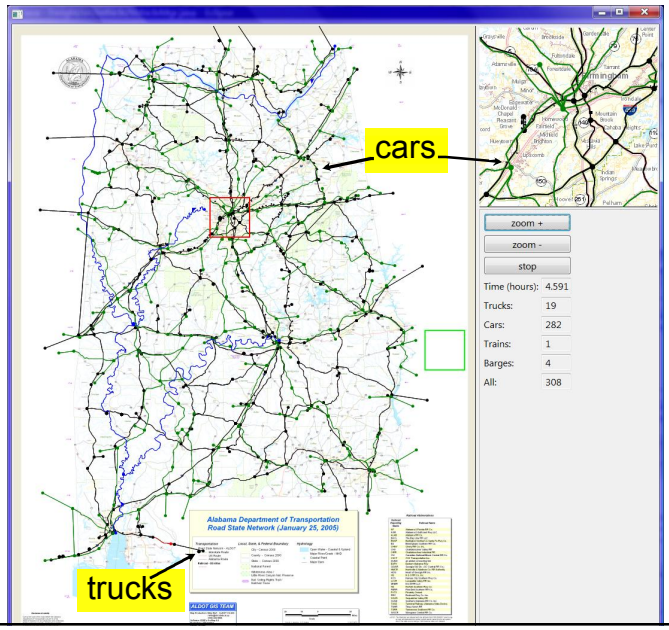
## Animated Visualization

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## Putting it all together

- The Integrated Freight Planning Framework (IFPF) is a valid approach to integrating freight into a comprehensive transportation planning process.
- The FAF2 database contains valuable and useful information which can enhance state and local level transportation infrastructure planning.
  - Relevant data can be extracted and manipulated through the use of a structured process like the Integrated Freight Planning Framework.
  - Supplemental information acquired from various sources, including primary research, can be integrated into datasets.
  - Development of transportation networks at the appropriate level (local, state, or nation) coupled with reasonable planning assumptions, produces useful insight for transportation system planning.



## Putting it all together

- A modular framework method to develop simulation tools is an efficient and effective approach to modeling transportation systems.
  - All modes of transportation can be accommodated through the use of a sub-model based programming architecture.
  - A modular model can be readily replicated for transportation networks, intermodal centers, and ports in other regions or states of the U.S.

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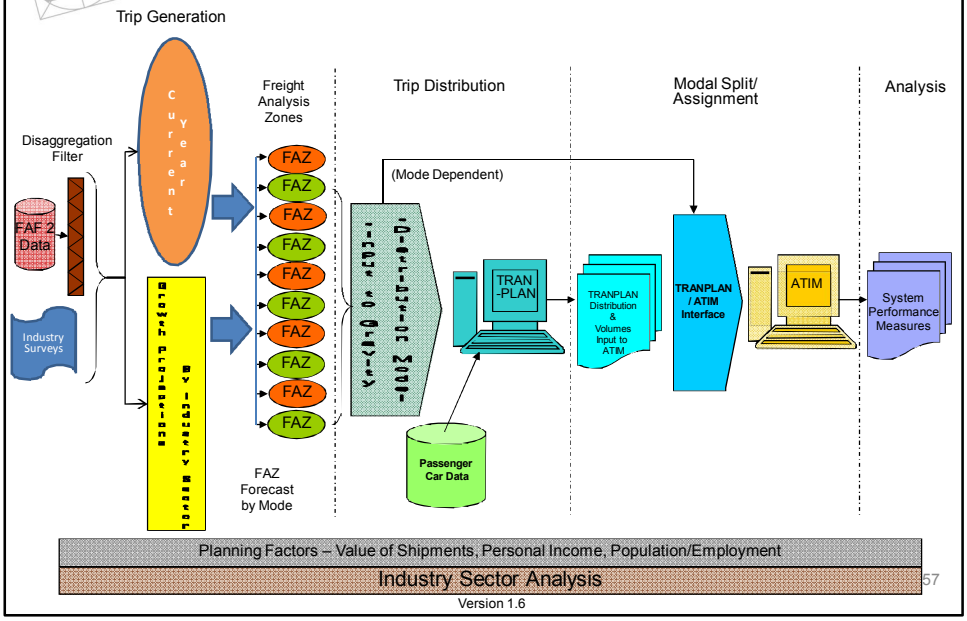
# Integrated Freight Planning Framework



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# Thank You

## Questions?

Gregory A. Harris, Ph.D., P.E. 256-824-6060 harrisg@uah.edu
Michael D. Anderson, Ph.D., P.E. 256-824-5028 mikea@eng.uah.edu
The University of Alabama in Huntsville